This listing of claims will replace all prior versions and listings of claims in this application.

Listing of Claims

1. (Currently Amended) An energy efficient pump apparatus, comprising:

a first closed conduit having a first and a second end; a first movable piston having a closed end having an effective length A greater than a median radius of the first closed conduit, the first movable piston being loosely disposed within the first closed conduit such that a first gap having a predefined median size is formed between the first movable piston and the first closed conduit, and

a flexible drive member connected to a top end of the first movable piston and operable to move the first movable piston up and down along the first closed conduit, wherein the flexible drive member is permitted to buckle,

(i) wherein the first movable piston is movable in the first closed conduit at a velocity relative to the first closed conduit such that as the first movable piston moves along the first closed conduit, the first movable piston creates a substantially tortuous leak path forming a hydrodynamic seal between the first movable piston and the first closed conduit, thereby enabling the first movable piston to displace fluid along the first closed conduit, and

(ii) an efficiency of the hydrodynamic seal is based on the predefined median size of the first gap, the effective length A of the first movable piston, and the velocity of the first movable piston.

2. (Previously Presented) The pump apparatus of claim 1 wherein the first movable piston further comprises a one-way valve disposed therein, and the first movable piston and the first closed conduit are arranged such that when the first movable piston is moved back and forth along the first closed conduit, the first movable piston pulls and pumps fluid along the first closed conduit.

3. (Previously Presented) The pump apparatus of claim 2 wherein the first closed conduit is positioned at an angle other than horizontal, the first closed conduit further comprises a one-way

inlet valve at a lower portion thereof, and the first movable piston and the first closed conduit are arranged such that when the first movable piston is moved up and down along the first closed conduit, fluid is pulled into and pumped up the first closed conduit.

4-5. (Canceled)

6. (Previously Presented) The pump apparatus of claim 1 further comprising a pipe having a top end and a bottom end, wherein (i) the bottom end of the pipe is attached to the top end of the first closed conduit, (ii) during an up-stroke of the pump apparatus, the first movable piston is pulled up by the flexible drive member, and (iii) during a down-stroke of the pump apparatus, the first movable piston is pulled down by gravity, thereby pulling and pumping fluid into and up the pipe.

7. (Previously Presented) The pump apparatus of claim 6 further comprising:

a second closed conduit having a top end and a bottom end, and including an outlet disposed at a lower end of the second closed conduit; and

a second movable piston loosely disposed within the second closed conduit such that a second gap having a predefined median size is formed between the second movable piston and the second closed conduit, the second movable piston including a rigid drive member,

wherein the bottom end of the second closed conduit is attached to the top end of the pipe, and

during operation of the pump apparatus the first and second movable pistons move in the respective first and second closed conduits to facilitate fluid flow into the first closed conduit, such that the fluid flows into and up the pipe on the up-stroke, and out of the outlet under pressure on the down-stroke.

8. (Previously Presented) The pump apparatus of claim 7 further comprising an outlet pipe connected to the outlet at the lower end of the second closed conduit and a one-way outlet valve

disposed in the outlet pipe to limit the amount of force required to move the first and second movable pistons on the up-stroke.

9. (Previously Presented) The pump apparatus of claim 7 further comprising:

a closed sleeve outlet conduit comprising a closed sleeve and an outlet pipe connected to an upper portion of the closed sleeve, the closed sleeve outlet conduit covering the second closed conduit and creating a second gap between an outer wall of the second closed conduit and an inner wall of the closed sleeve, such that the second gap is sealed both at a bottom and a top of the closed sleeve outlet conduit, and such that substantially any fluid flowing through the outlet at the lower end of the second closed conduit flows into the second gap,

wherein during operation of the pump apparatus the first and second movable pistons move in the respective first and second closed conduits to facilitate fluid flow into (i) the first closed conduit, into and up the pipe and into the second closed conduit during the up-stroke, and (ii) through the opening of the second closed conduit, into the sleeve-conduit gap and out of the outlet pipe under pressure during the down-stroke.

10. (Previously Presented) The pump apparatus of claim 9 wherein the sleeve outlet pipe includes a one-way valve disposed therein to limit the amount of force required to move the first and second movable pistons on the up-stroke.

11-31. (Canceled)